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JC06 Rec'd PCT/PTO 05 MAY 2003

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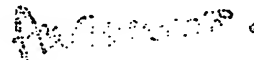
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17FEB03 E785223-1 001030  
P01/7700 0.00-0303468.3  
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# Request for grant of a patent

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1. Your reference

RFW/ND/CB60068

2. Patent application number

(The Patent Office will fill in his part)

0303468.3

14 FEB 2003

3. Full name, address and postcode of the or of each applicant (underline all surnames)

GlaxoSmithKline Consumer Healthcare GmbH & Co KG  
Bussmatten 1, D-77815 Buehl (Baden), , Germany

Patents ADP number (if you know it)

8304701001

If the applicant is a corporate body, give the country/state of its incorporation

German

4. Title of the invention

Toothbrush

5. Name of your agent (if you have one)

Corporate Intellectual Property

"Address for service" in the United Kingdom to which all correspondence should be sent

(including the postcode)

GlaxoSmithKline  
Corporate Intellectual Property (CN9 25.1)  
980 Great West Road  
BRENTFORD  
Middlesex TW8 9GS

Patents ADP number (if you know it)

8072555006

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or each of these earlier applications and (if you know it) the or each application number

Country Priority application number Date of filing  
(if you know it) (day / month / year)

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application Date of filing  
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8. Is a statement of inventorship and of right to grant of a patent required in support of this request? (Answer yes if:

- a) any applicant named in part 3 is not an inventor, or
  - b) there is an inventor who is named as an applicant, or
  - c) any named applicant is a corporate body
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10/533863  
PCT/EP 03/1243

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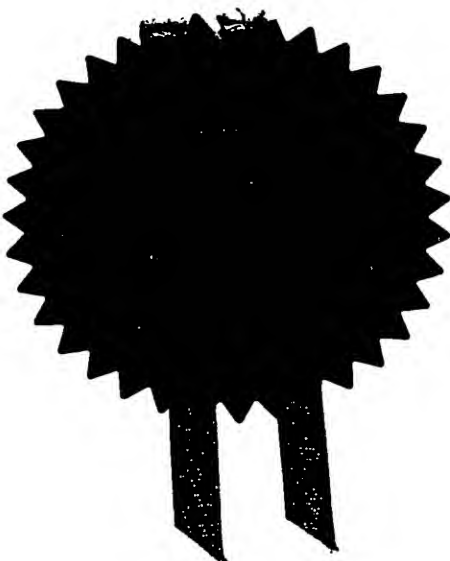
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I, the undersigned, being an officer duly authorised in accordance with Section 74(1) and (4) of the Deregulation & Contracting Out Act 1994, to sign and issue certificates on behalf of the Comptroller-General, hereby certify that annexed hereto is a true copy of the documents as originally filed in connection with the patent application identified therein.

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Signed *Andrew*

Dated 23 October 2003

Patent Act 1977  
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P01/7700 0.00-0303468.3  
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# Request for grant of a patent

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1. Your reference RFW/ND/CB60068
2. Patent application number 0303468.3  
(The Patent Office will fill in his part) 14 FEB 2003
3. Full name, address and postcode of the or of each applicant (underline all surnames) GlaxoSmithKline Consumer Healthcare GmbH & Co KG  
Bussmatten 1, D-77815 Buehl (Baden), , Germany  
Patents ADP number (if you know it) 8304701001  
If the applicant is a corporate body, give the country/state of its incorporation German
4. Title of the invention Toothbrush
5. Name of your agent (if you have one) Corporate Intellectual Property  
"Address for service" in the United Kingdom to which all correspondence should be sent  
(including the postcode) GlaxoSmithKline  
Corporate Intellectual Property (CN9 25.1)  
980 Great West Road  
BRENTFORD  
Middlesex TW8 9GS  
Patents ADP number (if you know it) 8072555006
6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or each of these earlier applications and (if you know it) the or each application number  
Country Priority application number Date of filing  
(if you know it) (day / month / year)
7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application  
Number of earlier application Date of filing  
(day / month / year)
8. Is a statement of inventorship and of right to grant of a patent required in support of this request? (Answer yes if:  
a) any applicant named in part 3 is not an inventor, or  
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Description → 11

Claim(s)

Abstract

Drawings → 10

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**Priority Documents**

Translations of priority documents

Statement of inventorship and right to grant of a patent (*Patents Form 7/77*)

Request for preliminary examination and search (*Patents Form 9/77*)

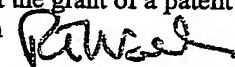
Request for substantive examination (*Patents Form 10/77*)

Any other documents  
(please specify)

11.

We request the grant of a patent on the basis of this application

Signature



Date 14-Feb-03

R F Walker

12. Name and daytime telephone number of person to contact in the United Kingdom

R F Walker 020 80474485

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## Toothbrush

This invention relates to toothbrushes and to toothbrush heads, in particular to toothbrushes with heads comprising plural sections which can bend under the pressures of toothbrushing. The invention also relates to a toothbrush provided with such a head.

Toothbrushes generally comprise a grip handle by which a user may hold the toothbrush and a bristle-carrying head, the head and handle being disposed along a longitudinal head-handle direction. Sometimes the head is replaceably connectable to the handle. Normally there is a neck between the head and the grip handle, being narrower than the adjacent part of the head and handle. The head has a tip end remote from the handle and a base end closest to the handle and the neck is joined to the head at the base end of the head. The junction between the base end of the head and the neck is generally marked by an inflexion point, i.e. a point of sharpest curvature between the head and neck as seen in plan looking down along the bristles carried by the head, or alternatively by for example the edge of the pattern of bristle tufts closest to the handle.

It is known to provide the head in the form of plural sections disposed widthways adjacent across the toothbrush head and being linked together at an end closest to the handle. For example US-A-1,323,042 discloses a toothbrush head comprising three flexible fingers, the middle finger being widened to form a pad adjacent the tip of the head. US D440,404 and US D436,446 disclose toothbrushes with their heads comprising three fingers, each linked to the grip handle by its own respective flexible neck. US-A-4, 864,676 discloses a head in the form of three such sections comprising a middle section laterally flanked by two outer sections, the ends of the outer sections remote from the handle forming a partial ring around the end of the middle section. WO-A01/89344 and FR-A-2548528 disclose heads comprising two such sections of which adjacent surfaces are of a complementary interlocking shape. US-A-4,472,853 discloses a head comprising three widthways adjacent flexible arms each having a bristle carrying pad at its extremity remote from the handle.

The purpose of such toothbrush heads comprising side by side sections able to bend in response to toothbrushing pressures is to improve the effectiveness of the head in reaching gaps between the teeth, particularly to achieve this improvement without application of excessive brushing pressures to the teeth, to distribute brushing pressures between the teeth and gums, and to allow a flow of water through the head so that the head may be thoroughly cleaned of for example excess toothpaste, debris etc. after use.

It is an object of this invention to provide an improved toothbrush of the above-mentioned type. Other objects and advantages of this invention will be apparent from the following description.

According to this invention a toothbrush head, being connected or connectable at its base end to a toothbrush grip handle to thereby define a head-handle longitudinal direction with a perpendicular width direction is provided, the head having a tip end longitudinally remote from the handle, and comprising three widthways adjacent, longitudinally extending bristle-carrying sections being a middle section and a lateral section on each widthways side of the middle section, one or more section being resiliently flexibly connected to the grip handle, and

wherein the middle section extends across the entire width of the toothbrush head adjacent to the tip end.

Preferably the head comprises only three such sections, i.e. a middle section and two lateral sections. Preferably two or more, preferably all of the sections, are flexibly linked to the grip handle. Preferably the one or more section is resiliently flexible under pressure applied in a direction perpendicular to both the longitudinal and width directions. For example the section may be resiliently bent out of a plane parallel to the longitudinal and width directions.

For example the section may be made of a resilient material integral with the grip handle of the toothbrush. For example two or more of the sections may be connected, e.g. integrally, to each other and/or to the toothbrush handle, at a part of the toothbrush remote from the tip end of the head.

The end of the middle section adjacent to the tip end of the head may be integrally enlarged to comprise a bristle-carrying tip pad adjacent to the tip end of the

head and which extends across the entire width of the toothbrush head adjacent to the tip end.

Typically such a tip pad may be approximately of equal dimensions in the widthways and longitudinal directions, e.g. being approximately circular, semi-circular, rectangular or polygonal. Typically in its longitudinal direction such a tip pad may have a length of ca. 10-50%, e.g. 20-30% of the toothbrush head between its base and tip ends.

Typically such a tip pad may be of a size suitable to carry a polygonal cluster of bristles, typically disposed in plural tufts containing plural bristles and extending in a bristle direction generally perpendicular to the longitudinal and width directions. Typically the tip pad is large enough to carry 4-10 tufts of bristles of the typical size of toothbrush bristle tufts e.g. tufts of 1-2 mm diameter or greatest sectional dimension. A suitable arrangement of tufts is a polygon of 5-8 tufts surrounding one or more central tuft.

The bristle carrying surface of the middle section may be substantially planar, or undulating, or may be curved e.g. concavely on the side on which the bristles are carried, or the bristle-carrying surface of such a tip pad may form an angle of 180° or less, e.g. 180°-160° with the surface, which may also be bristle carrying, of the adjacent part of the section closer to the handle, and preferably also with the bristle carrying surfaces of the lateral sections. Similarly the bristle carrying surface of the lateral sections may be substantially planar, or undulating or may be curved e.g. concavely on the side on which the bristles are carried.

In a preferred embodiment the tip pad extends longitudinally beyond the ends of the lateral sections remotest from the handle, typically for a distance of ca. 15-30%, e.g. 18-25% e.g. 20+/- 2% of the length of the toothbrush head between its base end and tip end.

The middle section may comprise a widthways narrow section extending from the base end of the head toward the tip end of the head from the direction of the handle and enlarging widthways adjacent to the tip end of the head to form such a tip pad.



The widthways adjacent longitudinally extending sides of the sections may be straight linear or alternatively they may be of a complementary interlocking shape, e.g. a complementary sinuous or undulating shape.

Each section may carry bristles, which may for example be disposed in one or more longitudinally extending row of tufts of bristles. Bristles may extend in a direction at a perpendicular or non-perpendicular angle to the longitudinal and width directions.

In a preferred embodiment the middle section comprises such a tip pad and an intermediate bristle carrying pad, being a region of maximum width of the part of the section between the tip pad and the base end of the head, from which plural tufts of bristles extend, with a first link region of the section between the tip pad and the intermediate pad being narrower in width than the adjacent part of the tip pad and the intermediate pad, and a second link region of the section between the intermediate pad and the base end of the head being narrower in width than the adjacent part of the intermediate pad.

Preferably there is only one intermediate pad, only one first link region and one second link region.

The junction between the tip pad or the intermediate pad and the adjacent first or second link region is preferably marked by an inflexion point, i.e. a point of sharpest curvature between the head and neck as seen in plan looking down along the bristles carried by the head.

Preferably the ratio of the widths of the tip pad and intermediate pad are in the range 1 : 1.5 to 1.5 : 1, e.g. in the range 1 : 1.2 to 1.2 : 1. Preferably the tip pad is wider than the intermediate pad.

The intermediate pad may for example have a length 20-30% of the length of the toothbrush head between the tip end and the base end of the head. The widest part of the intermediate pad may be closer to the base end of the head than to the tip end of the head, for example 20-40% of the distance from the base end of the head toward the tip end of the head.

The tip pad and intermediate pads may have bristle-bearing surfaces of substantially the same area, and/or may have thereon clusters of bristle tufts fitting

within an envelope of substantially the same area. For example the bristle-bearing surfaces of the tip pad and intermediate pad may differ by no more than 20% in area.

The intermediate pad may for example be circular, oval or polygonal in plan as viewed down the bristle direction. Typically the intermediate pad is large enough to carry 4-10 tufts of bristles of the typical size of toothbrush bristle tufts e.g. tufts of 1-2 mm diameter or greatest sectional dimension. A suitable arrangement of tufts is a polygon of 5-8 tufts surrounding one or more central tuft, for example including 2-4 tufts of bristles in line across the intermediate pad. The first and second link regions may for example narrow such that they carry only one tuft of bristles across their width.

The length of the first link region between the tip pad and the intermediate pad may for example be longer than the length of the respective tip pad or intermediate pad, for example being in the range 1 – 1.5 of the length of the tip pad or intermediate pad.

One or more section may also be resiliently flexible in a widthways outward and inward direction. To avoid excessive outward splay of a lateral section the middle and adjacent lateral section may be provided with abutment parts so that if a lateral section bends outwardly an abutment part of the lateral section abuts against an abutment part of the middle section to limit the extent to which the lateral section can move outwardly. For example an enlarged tip pad comprising the end of the middle section may have a concavity with an opening facing toward the grip handle and into which an abutment part of a lateral section may fit such that a surface of the concavity comprises a corresponding abutment part.

Between widthways adjacent sections there may be an air gap allowing relative movement of the adjacent sections. Alternatively widthways adjacent sections may be in contact, allowing sliding relative movement of the sections, for example in a relative direction perpendicular to both the longitudinal and widthways directions. There may be a flexible material, e.g. an elastomeric material, e.g. a thin flexible web of such a material, between widthways adjacent sections.

One or more section may be resiliently flexibly connected to the grip handle in various ways.

For example one or more, e.g. all of the sections may be connected to the grip handle by means of a flexible neck. Such a neck may extend between the base end of the section, i.e. the end of the section of the head remote from the tip end, and an end of the grip handle which is closest to the head. Typically in such a construction each  
5 section of the head may be connected to the grip handle by a respective neck section being an integral extension of the section toward the handle. Such a neck section may be approximately as long as the toothbrush head, e.g. having a length in the range 0.75 - 1.5 of the length of the head.

Alternatively one or more, e.g. all of the sections may be flexibly connected,  
10 e.g. at the base end of the head, to a neck which extends to the grip handle.

One or more, e.g. all of the sections, may be flexible, for example incorporating resiliently flexible links between longitudinally or widthways adjacent segments of the section.

Therefore the invention provides a preferred form of toothbrush in which:  
15 the end of the middle section adjacent to the tip end of the head is integrally enlarged to comprise a bristle-carrying tip pad adjacent to the tip end of the head and which extends across the entire width of the toothbrush head adjacent to the tip end, having in its longitudinal direction a length of ca. 20-30% of the toothbrush head between its base and tip ends, of a size suitable to carry a polygonal cluster of tufts,  
20 the bristle carrying surface of the tip pad forming an angle of 180° or less with the surface of the adjacent part of the section closer to the handle,  
the tip pad extending longitudinally beyond the ends of the lateral sections remotest from the handle,

the middle section comprising a single intermediate bristle carrying pad being  
25 a region of maximum width of the part of the section between the tip pad and the base end of the head, from which plural tufts of bristles extend,

with a first link region of the section between the tip pad and the intermediate pad being narrower in width than the adjacent part of the tip pad and the intermediate pad,

30 and a second link region of the section between the intermediate pad and the base end of the head being narrower in width than the adjacent part of the intermediate pad,

each section of the head being connected to the grip handle by a respective neck section being an integral extension of the section toward the handle.

As seen in plan looking along the bristle direction the middle section comprising the tip pad, first link region, intermediate pad and second link region consequently has a so called "dumb bell" shape.

The preferred construction provides that on the middle section the bristle tufts are concentrated on the tip pad and intermediate pad, e.g. with 60% or more, e.g. 60-80% of the bristle tufts located on the tip and intermediate pads, and the residue of tufts making up to 100% on the link regions.

In this preferred construction the two pads, i.e. the tip and intermediate pad are longitudinally separated by a distance corresponding approximately to the surfaces of the teeth, and therefore provide improved cleaning efficacy.

The toothbrush head of this invention may be integrally made of a resiliently flexible plastic material such as polypropylene, polystyrene etc., as well known for toothbrush manufacture. The head may also be integrally made of such plastic material with the grip handle, and/or with any neck or neck section longitudinally between the head and the grip handle.

The grip handle may be made of a plastic material such as the above, or may also comprise grip-enhancing parts of an elastomeric material, of a generally known type.

The invention will now be described by way of example only with reference to the accompanying drawings which show: -

Fig. 1 Shows a view of a toothbrush having a head of this invention in underside, side and plan.

Figs. 2 -7 Show various perspective, side and plan views of toothbrush heads of this invention.

Referring to Fig. 1 a toothbrush 10 is shown overall in an underside view (1A), side (1B) and plan (1C) views. The toothbrush 10 has a head 11, a grip handle 12 disposed along a longitudinal direction L-L, and has a width direction W-W perpendicular to the longitudinal direction. The head 11 has a base end 13 nearest to grip handle 12, and longitudinally between the head 11 and handle 12 is an integral neck 14.

The head 11 is divided into three widthways adjacent sections 15, 16, 17 being a middle section 15 flanked on each widthways side by two lateral sections 16, 17. Each section 15, 16, 17 is elongated parallel to the longitudinal direction L-L.

5 Adjacent to the tip end 18 of the head 11 the middle section 15 is enlarged into a tip pad 19 which occupies the entire width of the head 11 adjacent to this tip end 18. As shown in Fig. 1 the tip pad 19 is generally circular in plan. The middle section 15 therefore comprises a widthways narrow part 15A extending toward the tip end 18 of the head from the direction of the handle 12 and enlarging widthways adjacent to the tip end 18 of the head 11 to form the tip pad 19. In its longitudinal direction the tip  
10 pad 19 has a length of ca. 25% of the toothbrush head between its base and tip ends.

The junction between the base end 13 of the head and the neck 14 as seen in the plan views 1A and 1C is distinguished by an inflexion point 110, being a point of greatest curvature.

Bristles 20 extend from the upper surfaces of each of the sections 15, 16 17, in  
15 a bristle direction generally perpendicular to both the longitudinal direction L-L and the width direction W-W. The bristles 20 are disposed in discrete tufts. As shown in Fig. 1 the tufts are arranged in rows extending generally widthways across the head, and rows extending generally longitudinally along each section 15, 16 17.

The tip pad 19 is of a size suitable to carry a polygonal cluster of tufts of  
20 bristles 20.

Each of the sections 15, 16, 17 is also widthways enlarged at various places e.g. 15B, 16B, 17B to form pads of a width suitable to carry plural widthways adjacent tufts of bristles 20. Consequently, the widthways adjacent sides of adjacent sections 15, 16, 17 are shaped into interlocking corresponding sinuous shapes.

25 At the base end 13 of the head 11 each of the three sections 15, 16, 17 is integrally formed into a neck section 21, 22, 23 by which it is integrally connected to the grip handle 12. Each neck section 21, 22, 23 is made of resiliently flexible plastic material so that the neck section 21, 22, 23 flexibly and resiliently links its head section 15, 16, 17 to the grip handle 12. The length of each neck section 21, 22, 23 is  
30 approximately the same as the length of the head section 15, 16, 17, but may be varied to suit requirements.

The grip handle 12 is of generally conventional construction and design.

In use during toothbrushing, as pressure is applied in the bristle direction to the head 11, each of the sections 15, 16, 17 can independently move resiliently in the arc shown by arrows in Fig. 1B to allow the head 11 to better accommodate itself to the profiles of a user's oral tissues, and to relieve excessive toothbrushing pressure.

5 Referring to Figs. 2 - 6, alternative constructions of the toothbrush head of this invention are shown.

In Fig. 2 a head similar to that of Fig. 1 is shown enlarged in perspective (2A, 2E, 2F), and in underside (2B), side (2C) and plan (2D) views. It is seen that the bristle surfaces 21 of the lateral sections 16, 17 are of undulating shape as viewed in  
10 the width direction W-W, i.e. having upper and lower surfaces of alternating less or more displacement in the bristle direction from a plan parallel to the longitudinal and width directions. On the enlarged parts 15B, 16B tufts of bristles 20 are arranged widthways adjacent. Figs 2E and 2F show the sinuous interlocking shape of widthways adjacent sides of the sections 15, 16, 17.

15 In Fig. 3 a head 11 is shown enlarged in perspective (3A, 3E, 3F), and in underside (3B), side (3C) and plan (3D) views. The middle section 15 is enlarged at 15B into a widened part between the tip pad 19 and the base end, i.e. forming an intermediate pad. The widthways adjacent surfaces of the lateral sections 16, 17 are correspondingly shaped. On the enlarged parts 15B tufts of bristles 20 are arranged  
20 widthways adjacent. Fig. 3C shows that the surfaces of the sections 15, 16, 17 from which the bristles 20 extend are gently concave curved in their longitudinal direction, and the surface 19A of the tip pad 19 forms an angle of  $180^\circ$  with the surface of the adjacent part of section 15.

In Fig. 4 a head similar to that of Fig. 1 is shown enlarged in perspective (4A, 4E), and in underside (4B), side (4C) and plan (4D) views. It is seen that the middle  
25 section 15 has a widened part 15B occupying the part of section 15 closer to the handle, i.e. forming an intermediate pad, and a narrower part 15C between that narrow part 15B and tip pad 19. Also, which may be independent of other features of Fig. 4, the face 19A of tip pad 19, from which bristles extend, forms an angle less than  $180^\circ$   
30 with the adjacent face of part 15C from which bristles extend. In Fig. 4 the tip pad 19 is polygonal, approximately pentagonal, in plan.

A similar construction is shown in Fig. 5, except that the face 19A of tip pad 19, from which bristles extend is coplanar with the adjacent face of part 15C from which bristles extend. Again the middle section 15 is widened to form an intermediate pad 15B. Also, independently of this, bristle surfaces 21 of the lateral sections 16, 17 are of undulating shape as viewed in the width direction W-W.

In Fig. 6 a head similar to that of Figs. 2-5 is shown enlarged in perspective (6A), and in underside (6B), side (6C) and plan (6D) views. It is seen that the bristles 20 lean at non-perpendicular angles to the surfaces of the sections 15, 16, 17 from which they extend, so that as seen in the side view (6B) they are seen to cross. In Fig. 6 the tip pad 19 is approximately semicircular in plan.

In each of Figs 2-6 the neck sections 21, 22, 23 flexibly connect each section 15, 16, 17 to the grip handle.

In Fig. 7 a head similar to that of Fig. 1 is shown enlarged in perspective (7B), and in side (7A) and plan (7C) views. It is seen that the middle section 15 has an end adjacent to the tip end of the head integrally enlarged to form a bristle-carrying tip pad 19 which extends across the entire width of the toothbrush head adjacent to the tip end. This tip pad 19 is generally circular in plan, having in its longitudinal direction a length of ca. 20-30% of the toothbrush head between its tip end 18 and its base end 13.

The tip pad 19 is of a size suitable to carry a polygonal cluster of tufts 20A in the form of a polygonal pattern of tufts around a central tuft. As seen in 7A the bristle carrying surface of the tip pad 19 forms an angle of less than  $180^\circ$  with the surface of the adjacent part of the middle section 15 closer to the handle, and the tip pad 19 extends longitudinally beyond the ends of the lateral sections 16, 17, remotest from the handle.

There is an integral neck 14 between the base end 13 of the head and the grip handle (not shown), being narrower than the adjacent part 13 of the head and grip handle. The junction between the base end 13 of the head and the neck 14 is marked by an inflexion point, i.e. a point 13A of sharpest curvature between the head and neck as seen in plan (7C) looking down along the bristles 20 carried by the head. Each section 15, 16, 17 is linked to the handle by its own respective neck section 21, 22, 23.

In the toothbrush head of Fig. 7 the middle section 15 comprises a single intermediate bristle carrying pad 71 being a region of maximum width of the part of the section 15 between the tip pad 19 and the base end 13 of the head, from which plural tufts of bristles 20 extend, being arranged in a polygonal cluster surrounding two central tufts. The intermediate pad 71 is oval in plan (except where interrupted by the link regions to be described) and has an area in plan similar to the tip pad 19. The intermediate pad 71 has a length ca. 20-30% of the length of the toothbrush head between the tip end 18 and the base end 13 of the head. The widest part of the intermediate pad 71 is closer to the base end 13 of the head than to the tip end of the head 18.

There is an integral first link region 72 between the tip pad 19 and the intermediate pad 71 being narrower in width than the adjacent part of the tip pad 19 and the intermediate pad 71. There is a second link region 73 between the intermediate pad 71 and the base end 13 of the head being narrower in width than the adjacent part of the intermediate pad, and integrally linked to neck section 21. It is seen that there are inflexion points, i.e. of greatest curvature, defining the junctions between the pads 19, 71 and the link regions 72, 73. In Fig. 7 each of the link regions 72, 73 is parallel sided as seen in plan, although they could alternatively taper, being wider immediately adjacent to intermediate pad 71 than adjacent the neck region 21 or the tip pad 19. The length of the first link region 72 between the tip pad 19 and the intermediate pad 71 is longer than the length of both the tip pad 19 and the intermediate pad 71, being in the range 1 - 1.5 of the length of the tip pad.

It is seen that in plan the overall shape of the middle section is a "dumb bell" shape.

It is seen that the majority of the bristle tufts 20 on the middle section 15 are located on the tip pad 19 and intermediate pad 71, i.e. as seen in Fig. 7C there are ten tufts on the intermediate pad 71, seven tufts on the tip pad 19, and six tufts on the link regions 72, 73.



Fig. 1

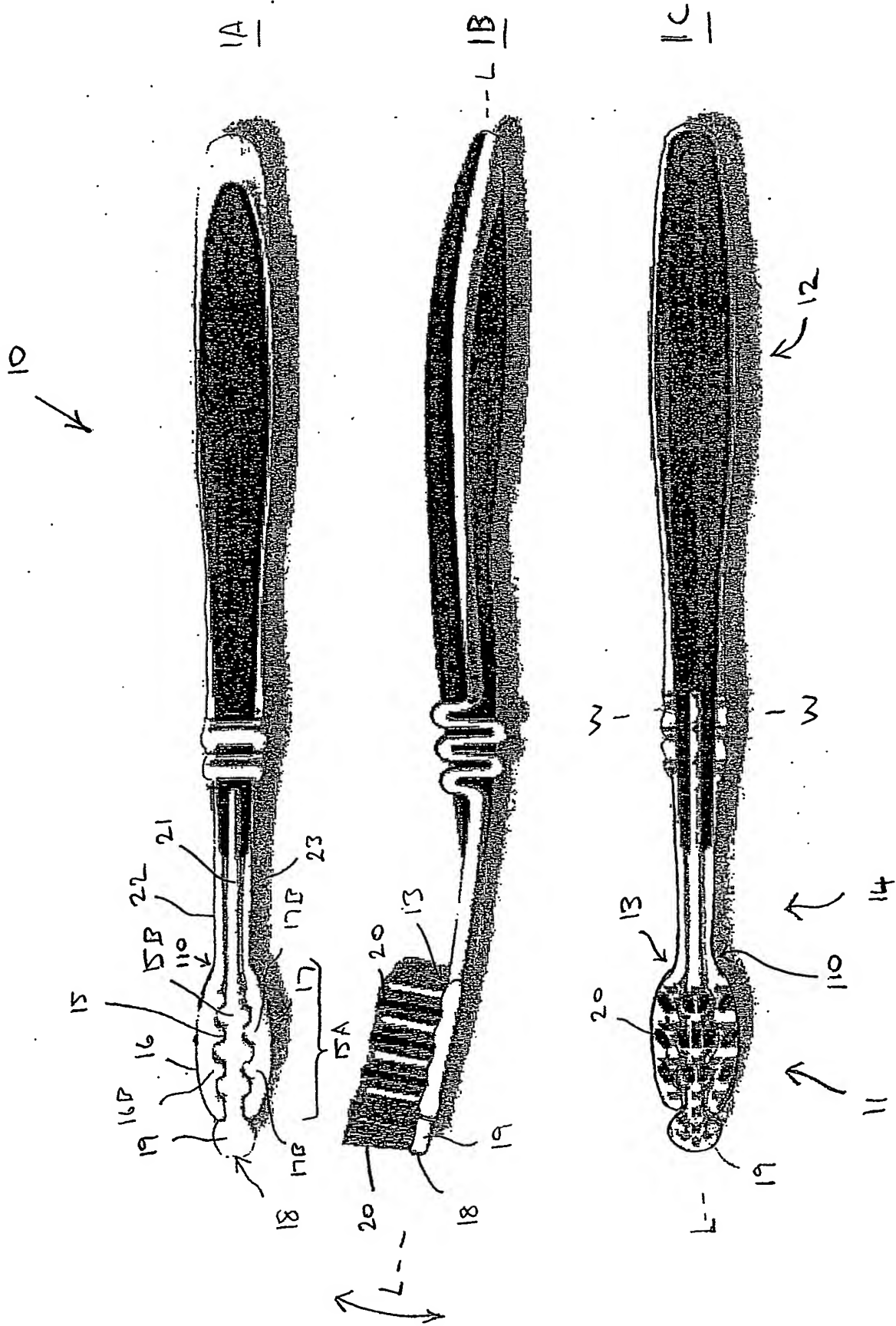


Fig. 2

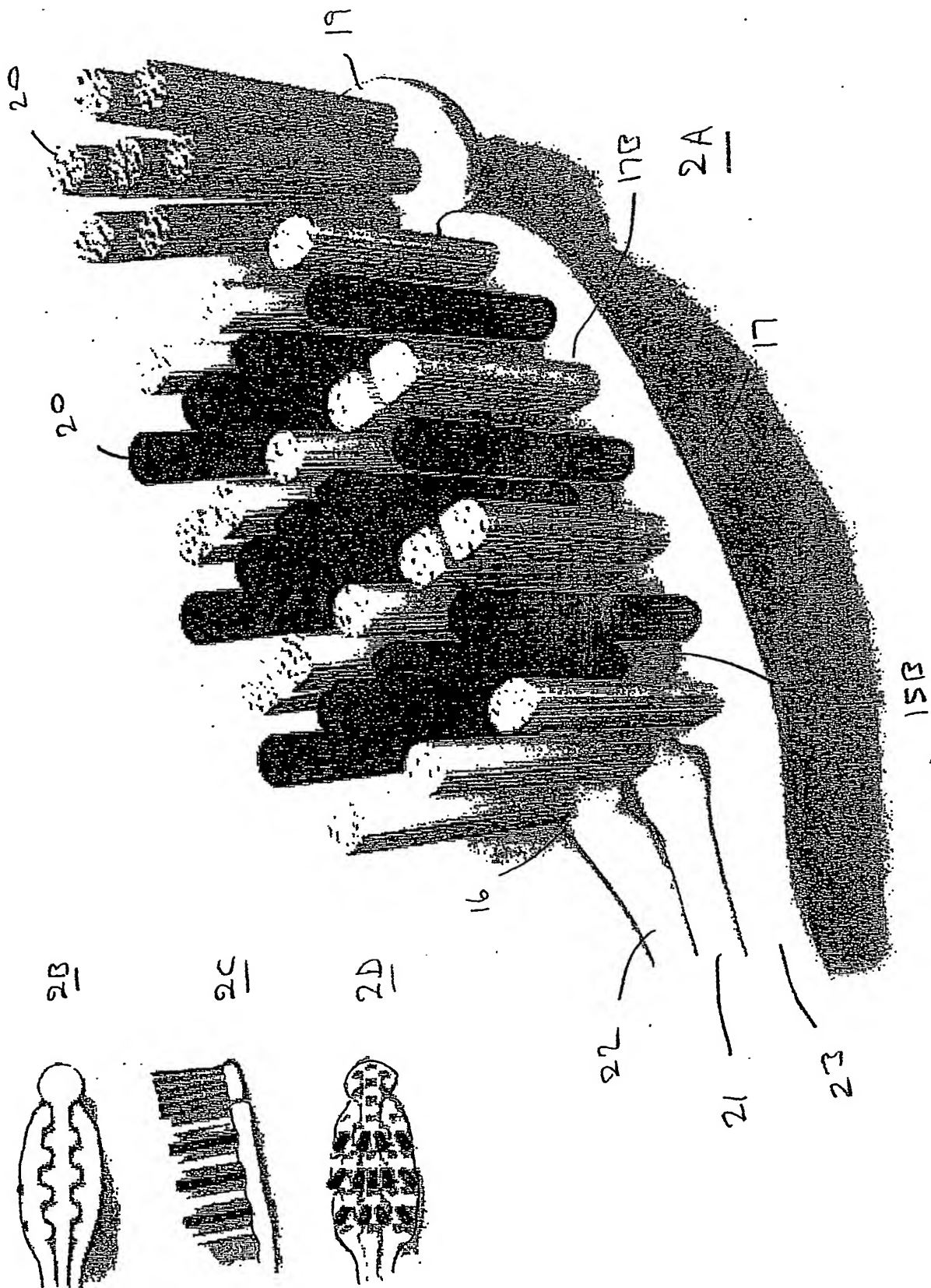


Fig. 2

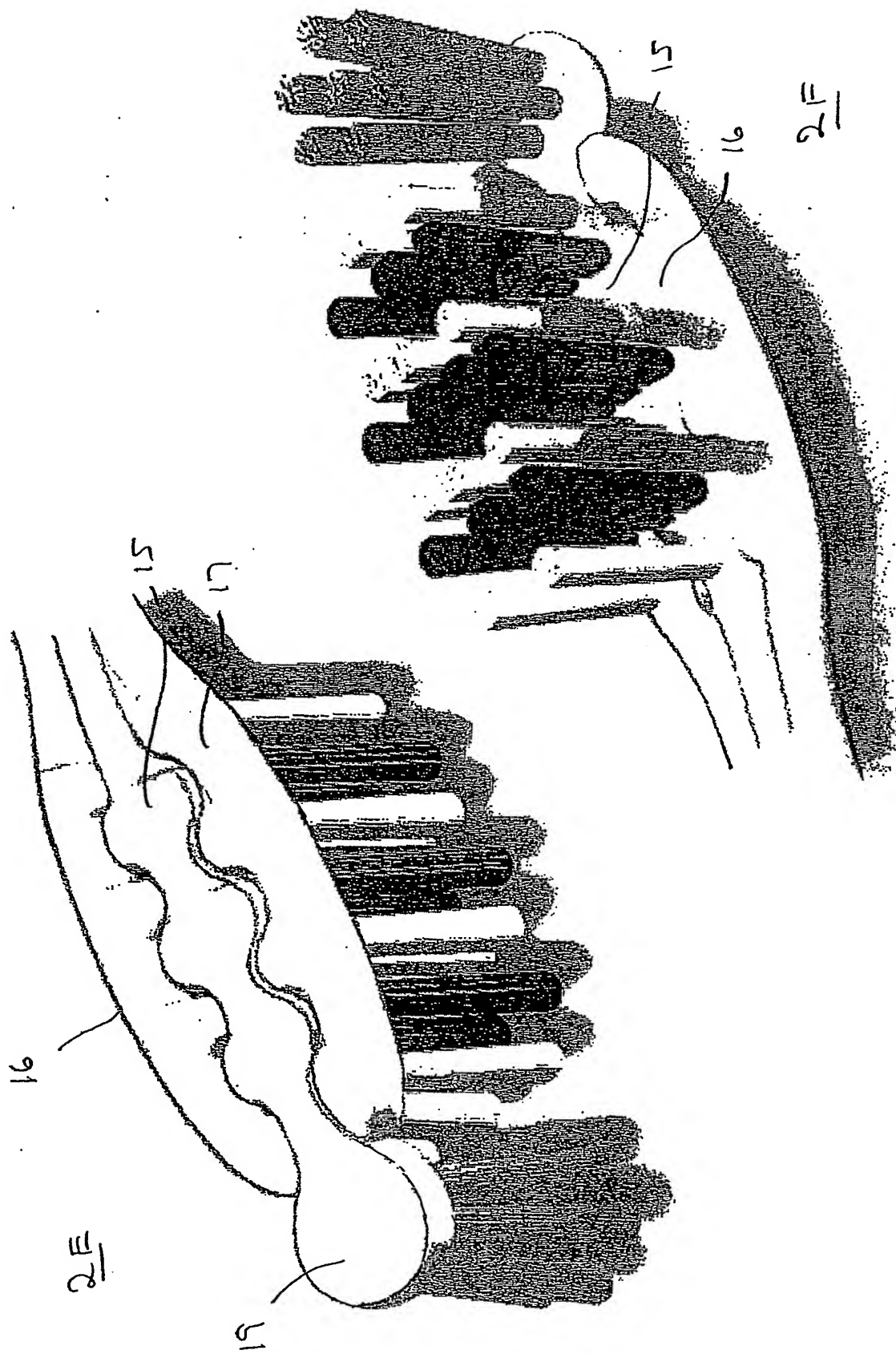


Fig. 3

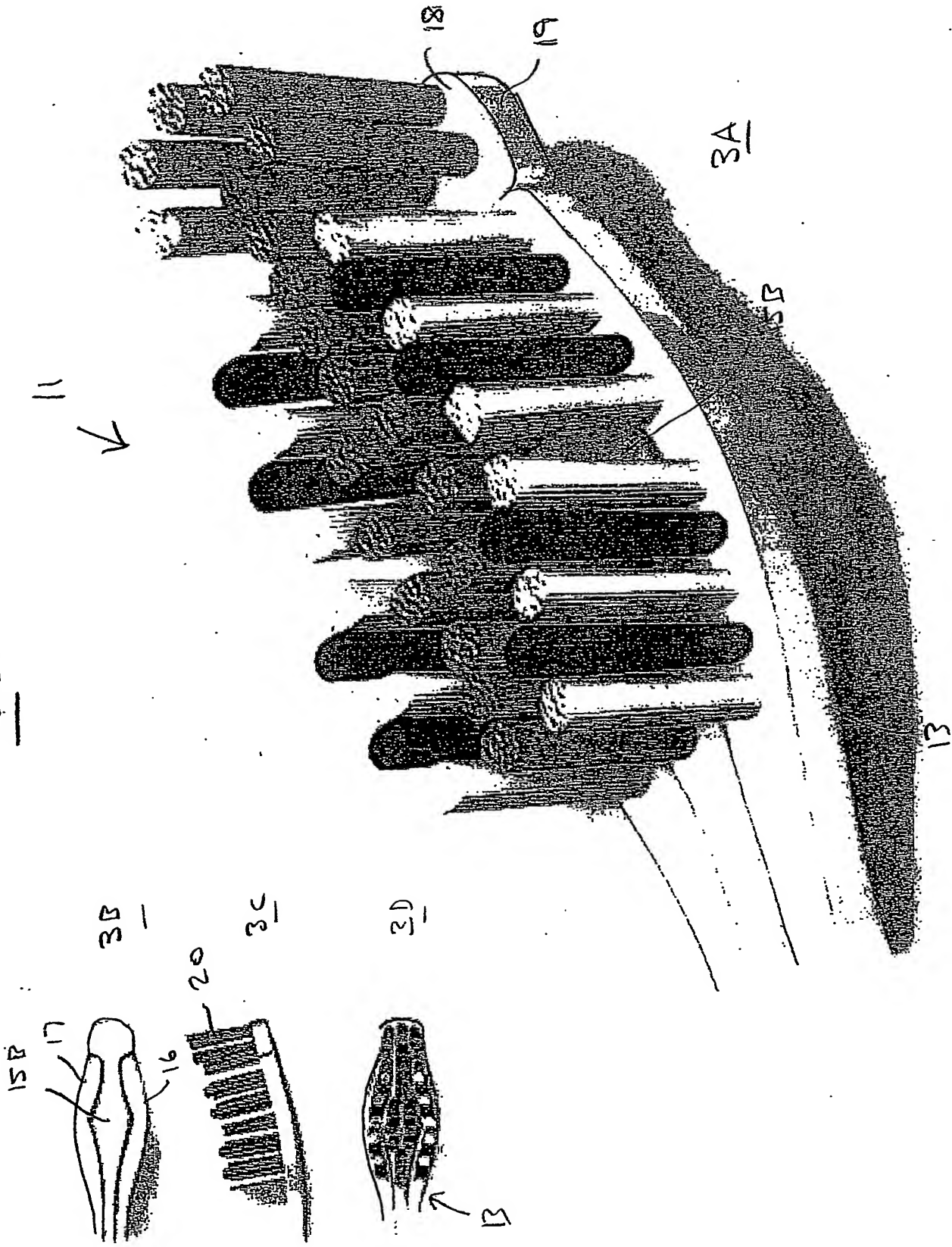


Fig. 3

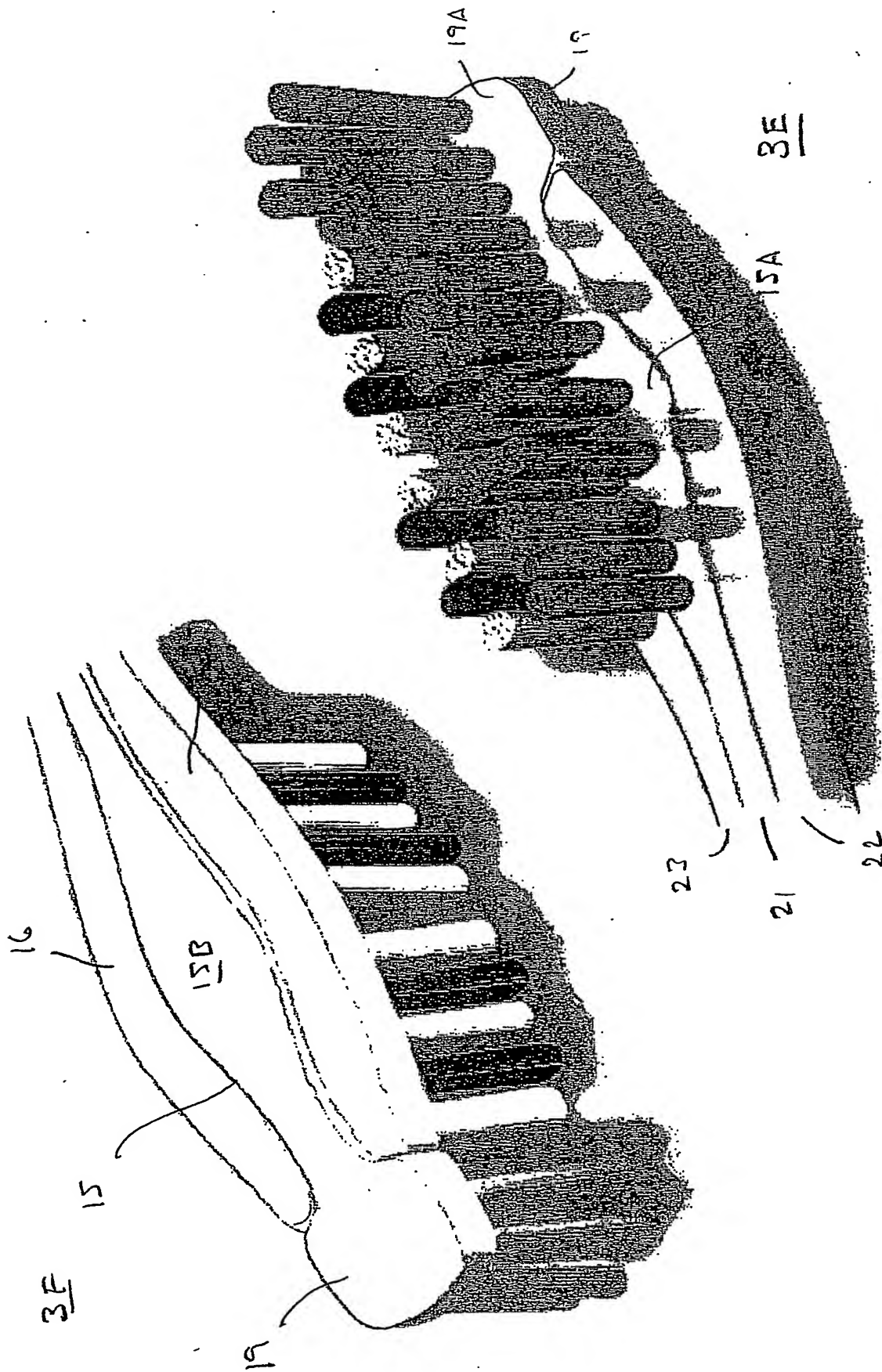
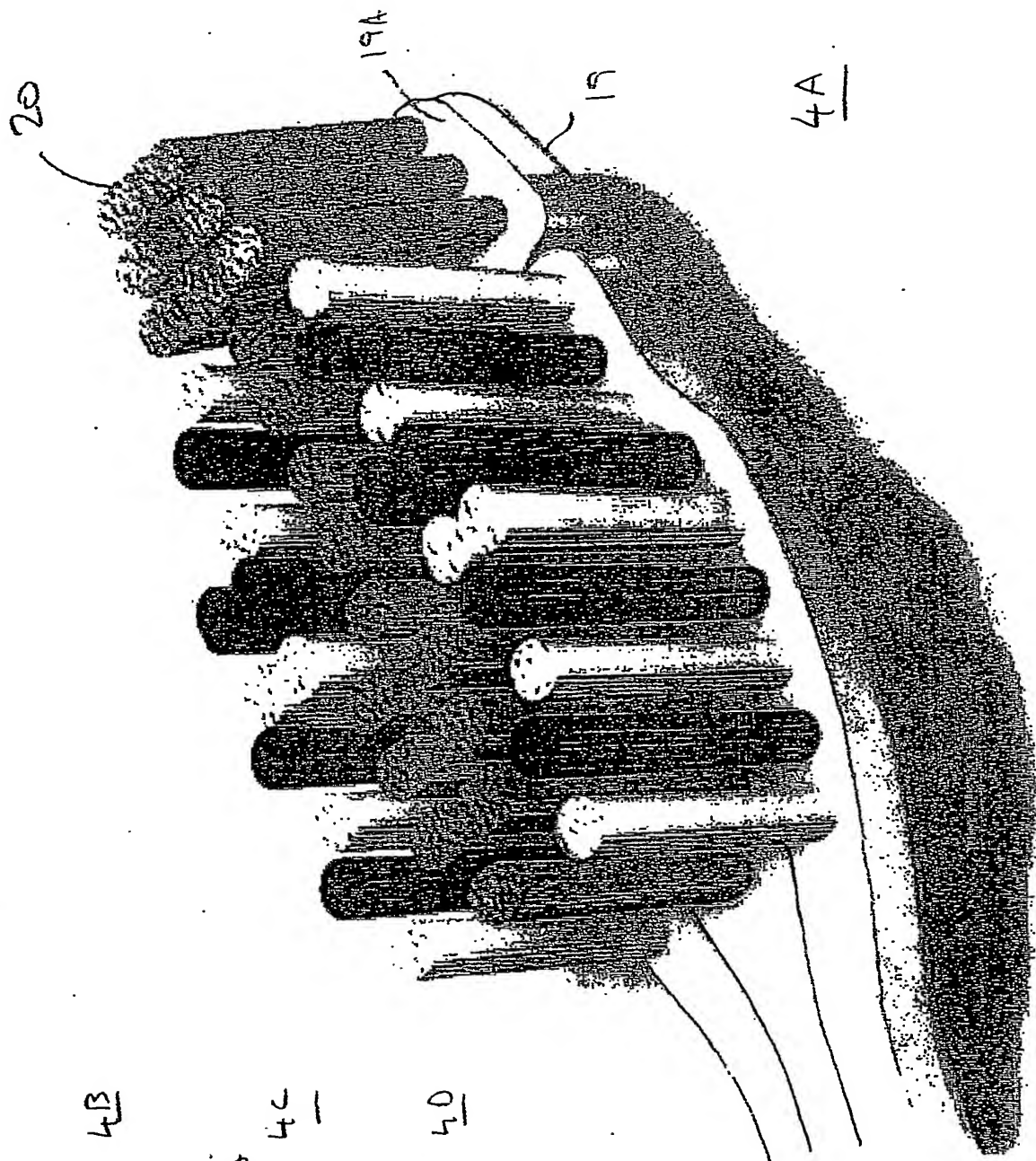
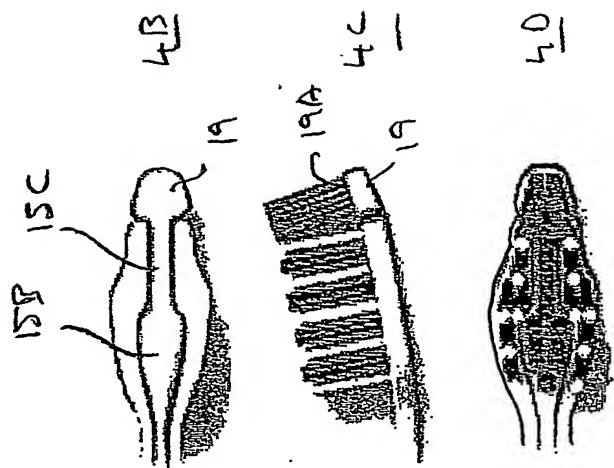


Fig. 4



4A

1.25

T

4E

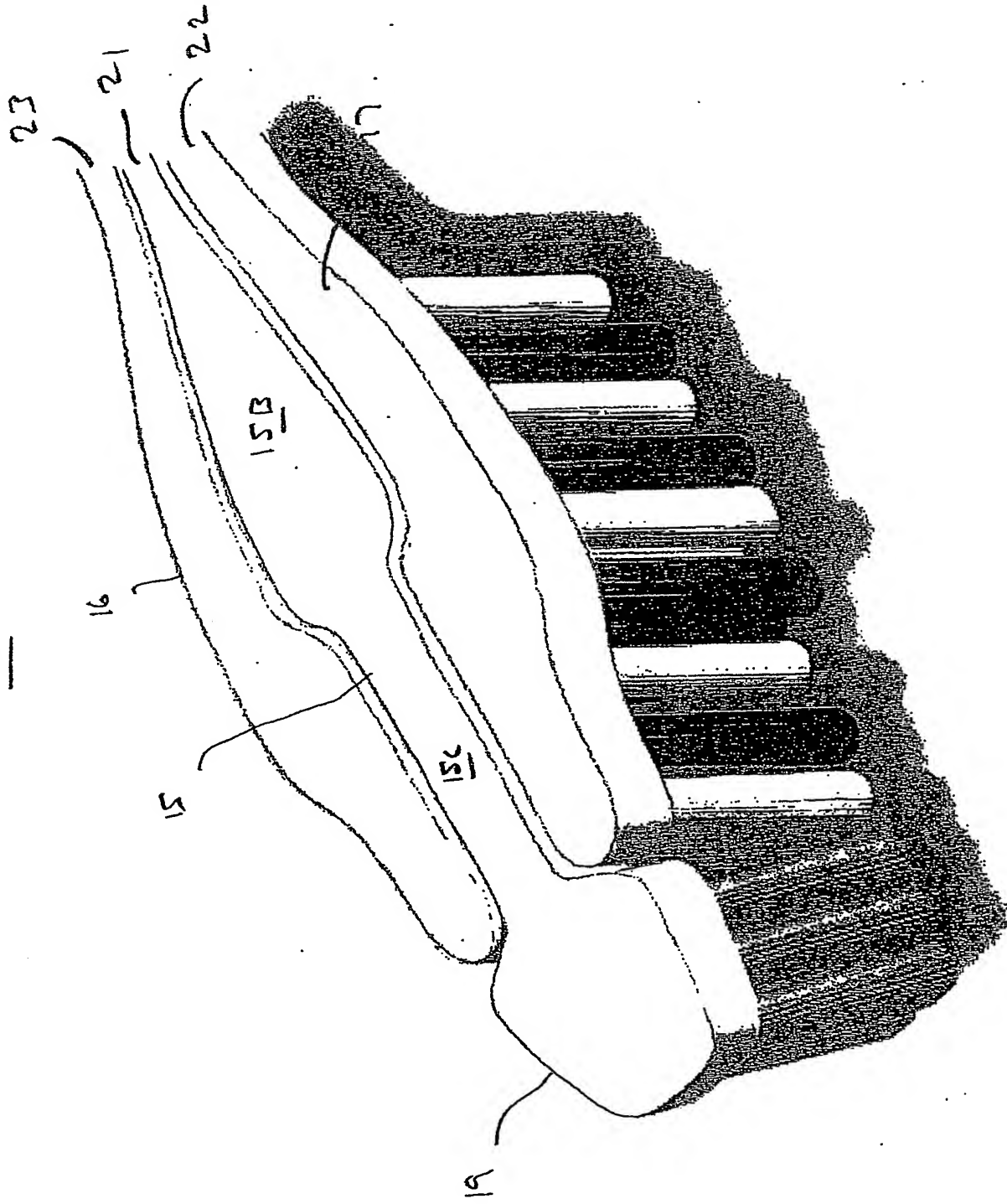
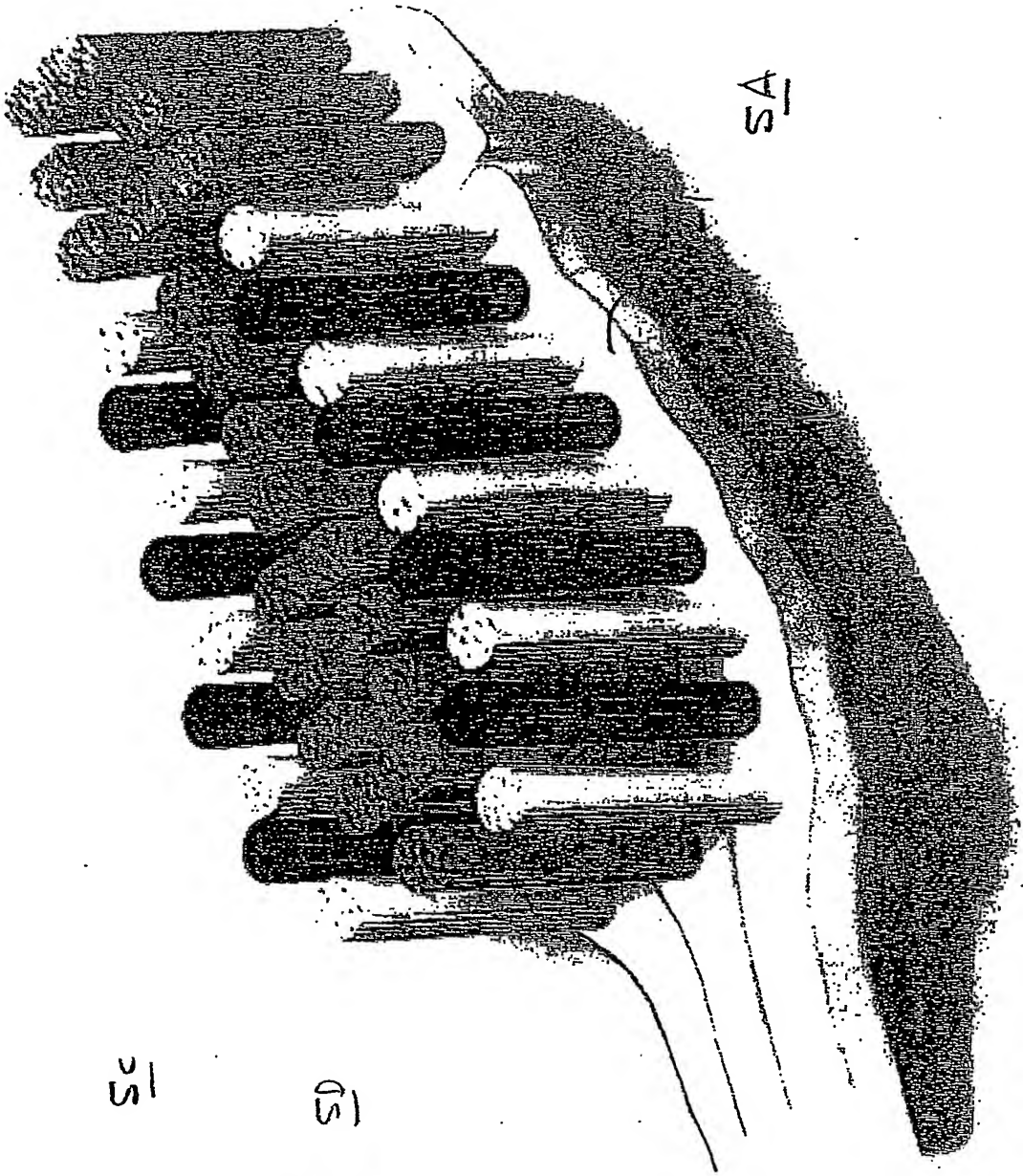
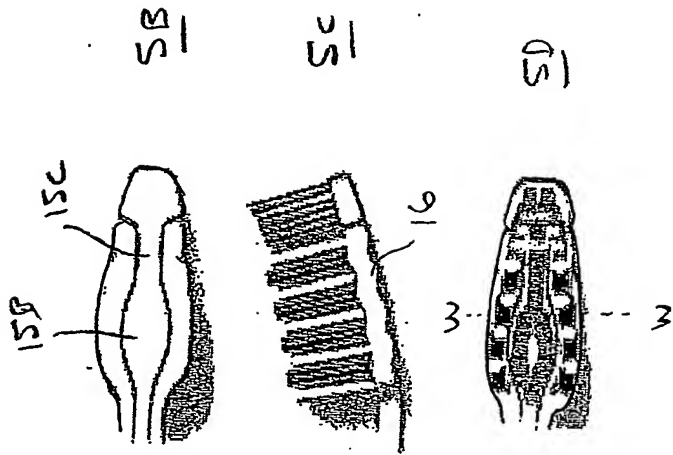




Fig. 5



15a

15b

15c

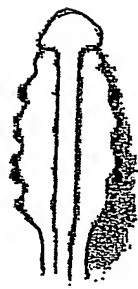
3

3

3



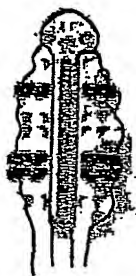
Fig. 6



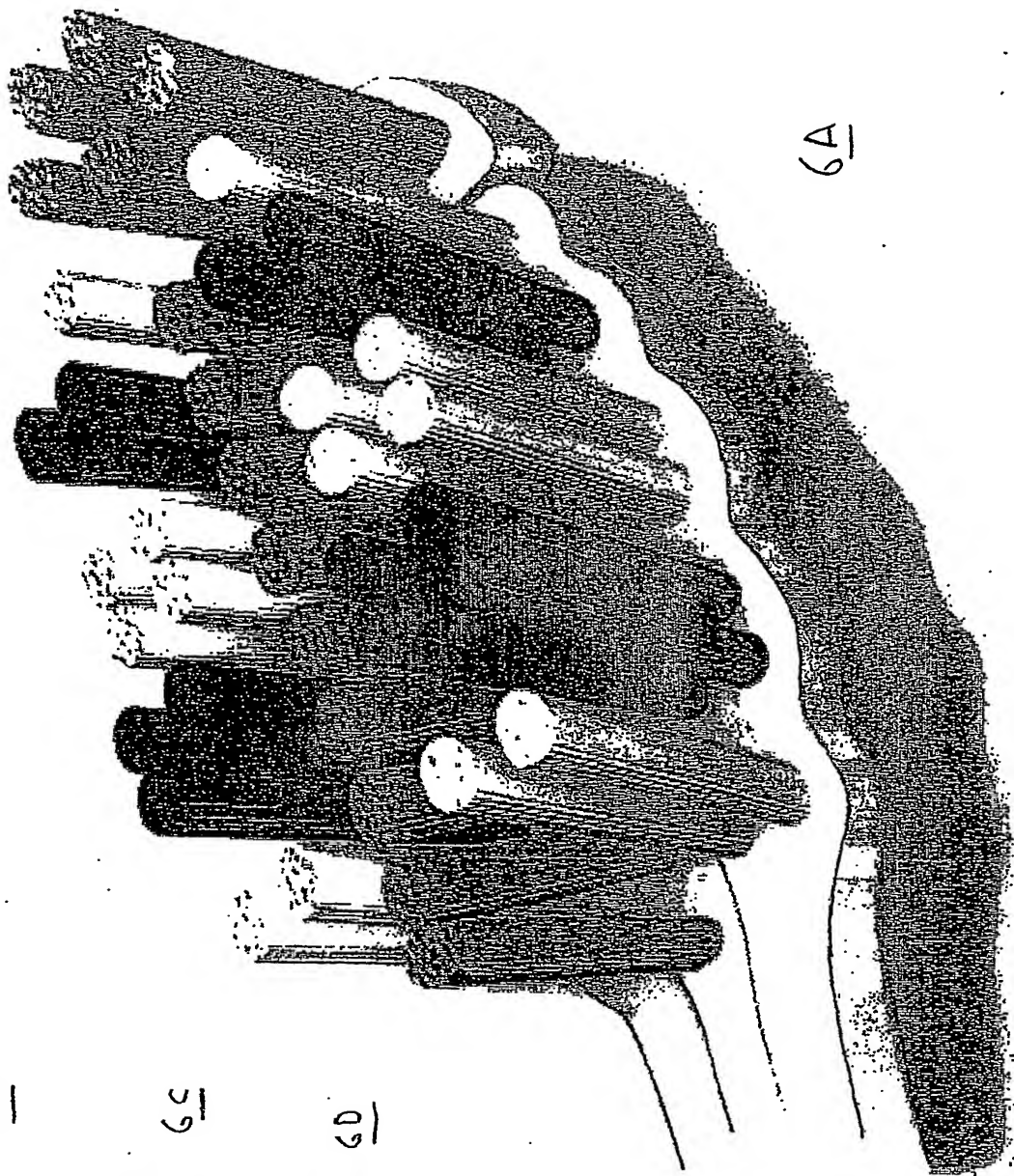
6B



6C

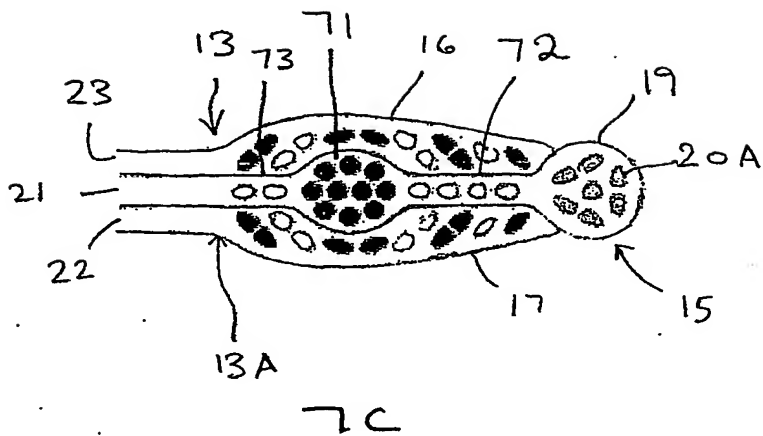
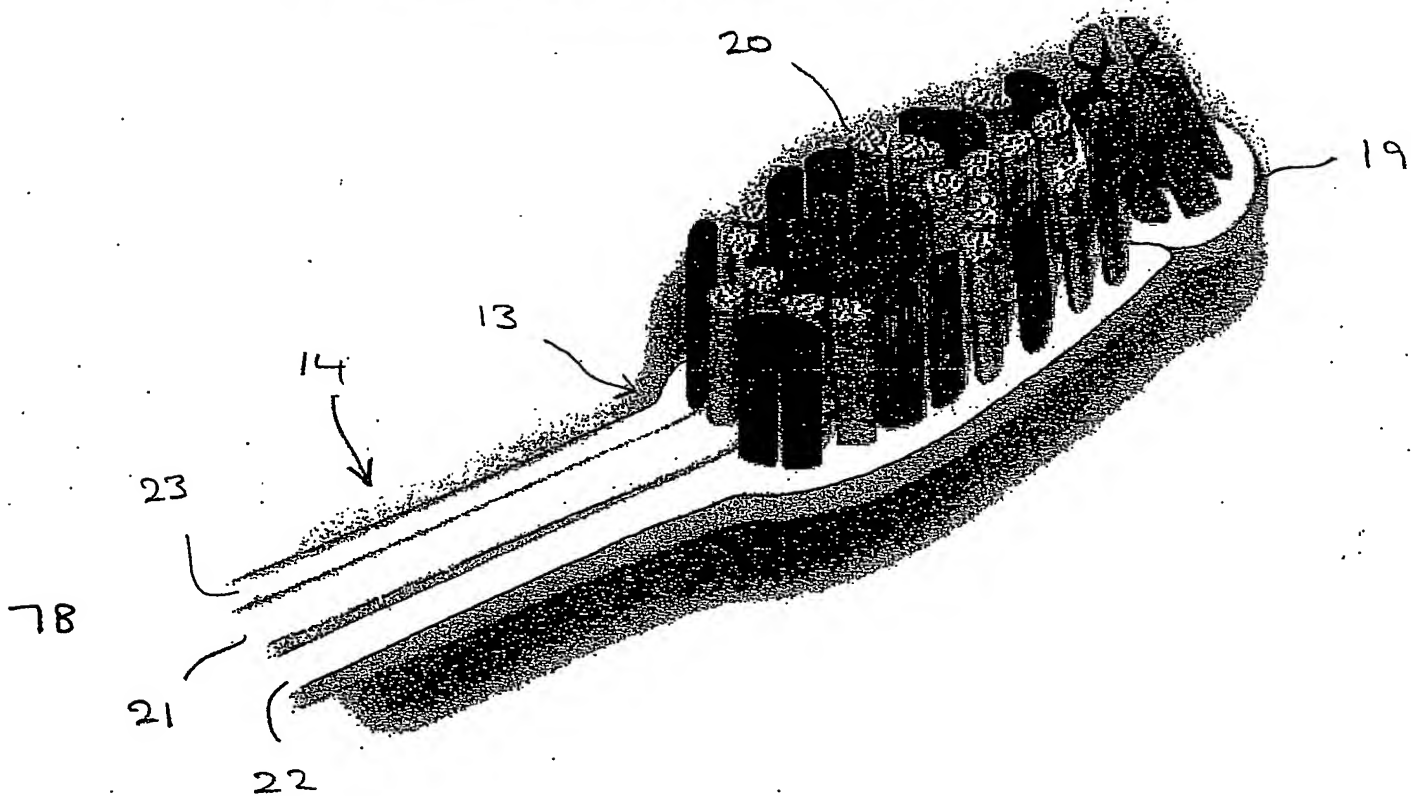
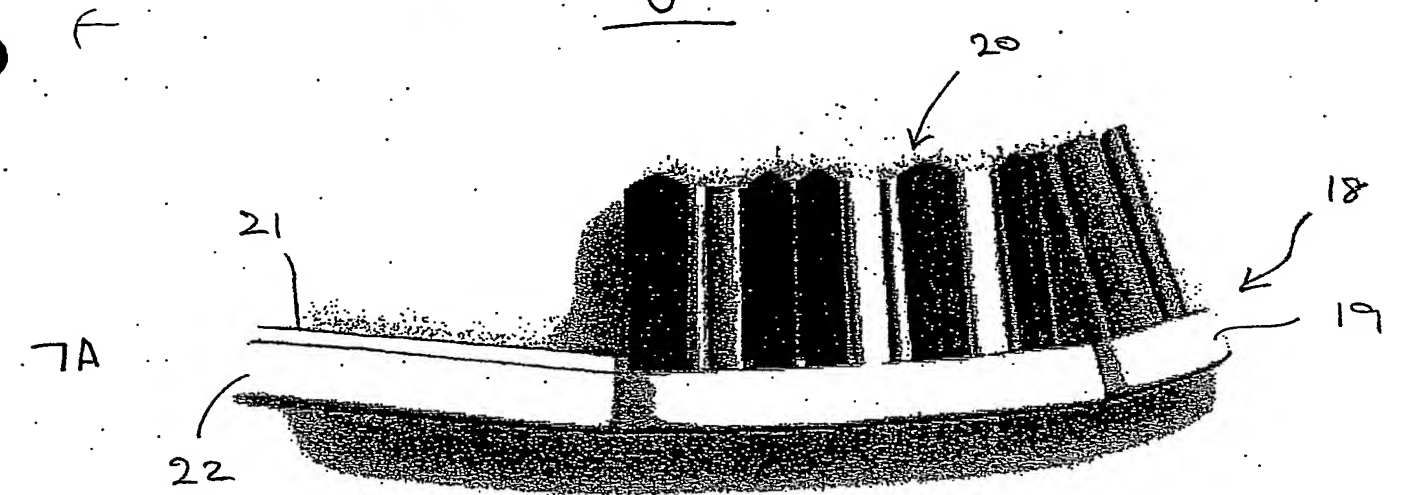


6D



6A

Fig. 7



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